

CLAIMS

1. A method of obtaining a motion of a mobile body on which a camera is mounted, using images of a surrounding of the mobile body captured by the camera, comprising:

5 a corresponding point calculation step of obtaining a plurality of corresponding points from two of the images having different capturing times;

 a first motion calculation step of obtaining a first motion indicating the motion of the mobile body using the plurality of corresponding points, assuming a predetermined plane in the images; and

10 a second motion calculation step of obtaining a second motion indicating the motion of the mobile body using the first motion and the plurality of corresponding points.

2. The method of claim 1, wherein the plane is a road surface, a ceiling surface, or a wall surface.

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3. The method of claim 1, wherein, in the first motion calculation step, the first motion is calculated using three of the corresponding points.

4. The method of claim 1, wherein the first motion calculation step comprises a
20 step of updating a plane expression defining the plane using the first or second motion which has been previously obtained.

5. The method of claim 1, wherein the first motion calculation step comprises:

25 a first step of selecting q (where q is an integer of two or more) partial corresponding point sets each composed of m (where m is an integer of 3 or more) corresponding points from the plurality of corresponding points;

 a second step of calculating a candidate for the motion of the mobile body from

each of the q partial corresponding point sets selected in the first step with a plane expression defining the plane; and

a third step of evaluating the q motion candidates calculated in the second step with a predetermined evaluation technique, and based on a result of the evaluation,
5 specifying the first motion.

6. The method of claim 5, wherein the first motion calculation step comprises a step of calculating a corresponding static point ratio which is a ratio of a corresponding static point or points using the plurality of corresponding points and the first or second
10 motion which has been previously obtained; and

in the third step, the calculated corresponding static point ratio is used for evaluation to specify the first motion.

7. The method of claim 5, wherein the first motion calculation step comprises a
15 step of obtaining a predicted value of the motion of the mobile body from the first or second motion which has been previously obtained; and

in the third step, the first motion is specified, taking the predicted value into consideration.

20 8. The method of claim 1, wherein in the second motion calculation step, the second motion is calculated using a search technique, in which the plurality of corresponding points are evaluated where the first motion is used as an initial value.

9. The method of claim 8, wherein in the second motion calculation step, the
25 evaluation is performed using a corresponding static point which is a ratio of a corresponding static point or points.

10. The method of claim 5, wherein the mobile body is a vehicle; and
in the second motion calculation step,

the partial corresponding point corresponding to the first motion and the
plane expression indicating the plane are used instead of the first motion, and

5 the second motion is obtained using a search technique, in which the
plurality of corresponding points are evaluated while inclining the plane around a center of
an axle near the camera where the plane expression is used as an initial value.

11. The method of claim 1, wherein the mobile body has a non-steered wheel
10 whose axle direction is fixed; and

in the first and second motion calculation steps, a vertical axis of a coordinate
system for representing the motion of the mobile body is placed perpendicular to a straight
line including the axle of the non-steered wheel, and a motion on a road surface of the
mobile body is obtained as a circular arc movement around the vertical axis.

15 12. The method of claim 11, wherein the vertical axis is placed passing through a
central position of the non-steered wheel.

13. An apparatus of obtaining a motion of a mobile body on which a camera is
20 mounted, using images of a surrounding of the mobile body captured by the camera,
comprising:

a corresponding point calculation section of obtaining a plurality of corresponding
points from two of the images having different capturing times;

a first motion calculation section of obtaining a first motion indicating the motion
25 of the mobile body using the plurality of corresponding points obtained by the
corresponding point calculation section, assuming a predetermined plane in the images;
and

a second motion calculation section of obtaining a second motion indicating the motion of the mobile body using the first motion obtained by the first motion calculation section and the plurality of corresponding points.

5 14. A navigation system comprising:

a navigation apparatus having a positional information obtaining section of obtaining positional information of a mobile body; and

the mobile body motion calculation apparatus according to claim 13,

10 wherein a current location of the mobile body is obtained based on the positional information obtained by the positional information obtaining section and a motion of the mobile body obtained by the mobile body motion calculation apparatus.